NOTE

First record of *Undaria pinnatifida* (Laminariales, Phaeophyceae) in beach-cast macroalgae from the southeastern coast of Buenos Aires province, Argentina

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ABSTRACT. *Undaria pinnatifida* (Harvey) Suringar 1873 is a marine brown macroalga of the order Laminariales, native to northern Asia. This species has an invasive behaviour, currently present on several coasts worldwide, including Argentina. Along the coast of Mar del Plata (Buenos Aires province), sporophytes of *U. pinnatifida* have been found growing within the local harbour area, but no information is available about its distribution in other coastal areas outside this harbour. In this note, we report for the first time the presence of *U. pinnatifida* outside the local harbour. The sporophytes appeared in a beach-cast macroalgal accumulation on a sandy beach located more than 15 km south of the local harbour. The data collected from the *U. pinnatifida* thalli studied (relative wet biomass, size, maturity, and preservation state) suggests that this species may be present in subtidal macroalgal assemblages beyond the harbour limits. It is therefore expected that the occurrence of *U. pinnatifida* in coastal beach-casts will increase, particularly during summer. The biomass of macroalgae deposited on sandy beaches can be utilized in a wide variety of applications. In this context, the presence of *U. pinnatifida* in beach-cast accumulations may represent a new, locally available resource, opening additional opportunities for its exploitation in the region.

Key words: Kelp, drift accumulation, Mar del Plata, algae assemblage, new record.

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Primer registro de *Undaria pinnatifida* (Laminariales, Phaeophyceae) en arribazones de macroalgas en la costa sudeste de la Provincia de Buenos Aires, Argentina

RESUMEN. *Undaria pinnatifida* (Harvey) Suringar 1873 es una macroalga parda marina del Orden Laminariales, nativa del norte de Asia. Esta especie exhibe un comportamiento invasor, estando presente actualmente en varias costas del mundo, incluida la Argentina. A lo largo de la costa de Mar del Plata (Provincia de Buenos Aires, Argentina), se han registrado esporofitos de *U. pinnatifida* creciendo dentro del área portuaria, pero no se dispone de información sobre su distribución en otras áreas costeras fuera de este puerto. En la presente nota, informamos por primera vez la presencia de *U. pinnatifida* en un arribazón de macroalgas en una playa ubicada a más de 15 km al sur del puerto. Los datos obtenidos de los talos de *U. pinnatifida* estudiados (biomasa húmeda relativa, el tamaño, el grado de madurez y el estado de preservación) sugieren que esta especie podría estar presente en los ensambles de macroalgas submareales más allá de los límites del puerto. Por lo tanto, se espera que la ocurrencia de *U. pinnatifida* en los arribazones de algas aumente, particularmente durante el verano. La biomasa de macroalgas arribadas en las playas de arena puede ser utilizada en una

amplia variedad de aplicaciones. En este contexto, la presencia de *U. pinnatifida* en los arribazones podría representar un nuevo recurso disponible localmente, abriendo oportunidades adicionales para su aprovechamiento en la región.

Palabras clave: Kelp, arribazón, Mar del Plata, ensamble de algas, nuevo registro.

Beach-cast macroalgae, also known as wrack or drift accumulations, consist of large volumes of marine algae that are occasionally deposited along shorelines (Gilson et al. 2021). These accumulations are generally associated with storms or oceanographic conditions (e.g. waves and currents) that cause the detachment of benthic macroalgae from nearby subtidal communities (Kirkman and Kendrick 1997). In addition to these occasional events, macroalgae may reach the shore through detachment processes related to their life cycles or senescence. Beach-cast events have been reported worldwide and tend to be more intense in regions with extensive subtidal meadows of large macroalgae or seagrasses (Hyndes et al. 2022). In the southwestern Atlantic Ocean, the largest beach-cast macroalgal accumulations occur along the Argentine Patagonian coast (south of 42° S), where subtidal macroalgal communities are dominated by large kelp species (e.g. *Macrocystis pyrifera*, *Lessonia* spp., and *Undaria pinnatifida*; see Boraso 2013) that form extensive underwater forests. Beach-cast macroalgae of smaller scale, due to the absence of kelp forest, have been reported during the austral summer season along the southeastern coast of Buenos Aires province (37° S-38° S), where they can reach high biomass and are composed of a diversified assemblage of predominantly subtidal species (Becherucci and Benavides 2016, Schejter et al. 2025).

Beach-cast macroalgae represent an important source of biological information for surveying marine species (e.g. indicate changes in species dominance; Piriz et al. 2003) that are difficult to monitor directly. This is particularly relevant along the cost of Mar del Plata (Buenos Aires province, Argentina), where subtidal sampling by SCUBA diving is frequently limited by environmental conditions, including wind intensity and direction, current regimes, and suspended or resuspended sediments that reduce underwater visibility (Genzano 2017). Because these beach-cast events occur primarily during summer, they may provide indirect but continuous information on long-term trends of subtidal macroalgal assemblages (Boraso de Zaixo and Akselman 2005; Becherucci and Benavides 2016).

Undaria pinnatifida (Harvey) Suringar 1873 is a marine brown macroalga of the order Laminariales, native to northern Asia (Japan, China, and Korea). This species has been widely introduced and established along several coasts worldwide (e.g. Silva et al. 2002; Russell et al. 2008; Veiga et al. 2014). In Argentina, *U. pinnatifida* was accidentally introduced in 1992 in Puerto Madryn (Patagonian coast) and subsequently expanded both southwards and northwards along the coast (Casas and Piriz 1996). The current southernmost distribution is the Ría de Puerto Deseado in Santa Cruz province, and the northernmost distribution is the southeastern coast of Buenos Aires province (Martin and Cuevas 2006; Meretta et al. 2012). Its arrival and attachment into new sites have been associated primarily with maritime traffic, while its secondary spread has occurred through spore dispersal, drifting detached sporophytes, and additional human-mediated introductions (Dellatorre et al. 2014). *Undaria pinnatifida* has a heteromorphic annual life cycle characterized by a macroscopic sporophyte and microscopic sexual gametophytes. The sporophyte grows from winter to spring and is composed of a blade, stipe, sporophylls, and holdfast (Figure 1 C). In spring, sporophylls develop along the lower part of the stipe and release millions of zoospores. These spores attach to substrates such as rocks and germinate into dioecious gametophytes. After the zoospores release, the sporophyte undergoes se-

nescence and eventually disintegrates (Sato et al. 2020).

Along the coast of Mar del Plata, sporophytes of *U. pinnatifida* were found growing from the subtidal-intertidal limit down to 4.5 m depth inside the harbour area in 2011 (Meretta et al. 2012). Until now, it was believed that the species distribution remained confined to the harbour environment, colonizing artificial structures like breakwaters, pilings, and vessel hulls. However, during a recent survey on a sandy beach located more than 15 km from the harbour, we detected the presence of *U. pinnatifida* in a beach-cast macroalgal accumulation. The aim of this note is to report, for the first time, the presence of *U. pinnatifida* in a beach-cast macroalgal assemblage located outside the harbour of Mar del Plata, and to compare its floristic composition with that of a beach-cast recorded north of Mar del Plata ten years earlier.

The beach-cast reported here occurred at the beginning of January 2026 on Acantilados Beach (38° 08′ S-57° 34′ W), south of the city of Mar del Plata, and covered an area of approximately 60 m^2 (30 m × 2 m), showing a notably patchy distribution (Figure 1 A and B). Samples were standardized by wet weight (10 samples of 259.5 ± 29.28 g, mean ± SD), which was measured in the field using a portable balance. Fixed-weight samples were randomly collected within the macroalgal patches, and each sample was placed in a separate labelled plastic bag. In the laboratory, samples were rinsed and cleaned in trays containing seawater to remove sediment, associated invertebrates, litter, and other debris. Subsequently, each taxon was separated, identified, and weighed. The identification of each taxon was to the lowest possible taxonomic level, and taxonomic status and nomenclature followed AlgaeBase (Guiry and Guiry 2026). The wet weight (g) of each species was recorded using a scale with a precision of 0.001 g. The fraction that could not be separated as a distinct thallus was registered as 'algal remains' and consisted of fragmented and entangled thalli, mostly belonging to filamentous algae. In addition, ten individuals of *U. pinnatifida* were randomly selected from the beach-cast material for morphometric measurements. The lengths of the blade and sporophyll (excluding the holdfast) were measured with the aim of a ruler (precision 1 cm). For each species, biomass was expressed as the percentage contribution to the total wet biomass collected across all samples.

Comparing the taxonomic composition of the beach-cast of 2026 with the beach-cast of 2016, it is noteworthy that among the brown algae, *U. pinnatifida* was detected for the first time in the beach-cast examined in this study (Table 1). All measured thalli were adults and fertile, with visible sporophylls that measured 8.9 ± 2.3 cm in length, while blade length measured 35.4 ± 10.2 cm. The relative wet biomass, size, maturity, and preservation state of the *U. pinnatifida* thalli suggest the presence of established populations in subtidal macroalgal assemblages beyond the harbour limits. In particular, the high proportion of fertile individuals indicates an actively reproducing population, while the good preservation and structural integrity of the stranded thalli suggest limited drift time prior to stranding. Together, these observations indicate that the source populations are likely located relatively close to the surveyed beaches rather than originating from distant areas. However, determining the extent of its spatial distribution requires to conduct a more exhaustive survey at the subtidal zone of the surveyed beach. The study area is surrounded by coastal cliffs; thus, the adjacent subtidal zone likely contains hard substrate (abrasion platform of loess; see Amor et al. 1991) capable of supporting macroalgal assemblages. Moreover, the beach is protected by detached breakwaters constructed with cement and quartzite rocks to prevent coastal erosion (Mojica et al. 2022), which may provide additional hard substrate for macroalgae in this otherwise sandy environment.

Since its first occurrence on the Patagonian coasts, *U. pinnatifida* has been claimed to represent more than 50% of the stranded algal biomass during the summer months (Eyras and Sar 2003; Piriz et al. 2003), which coincides with the peak

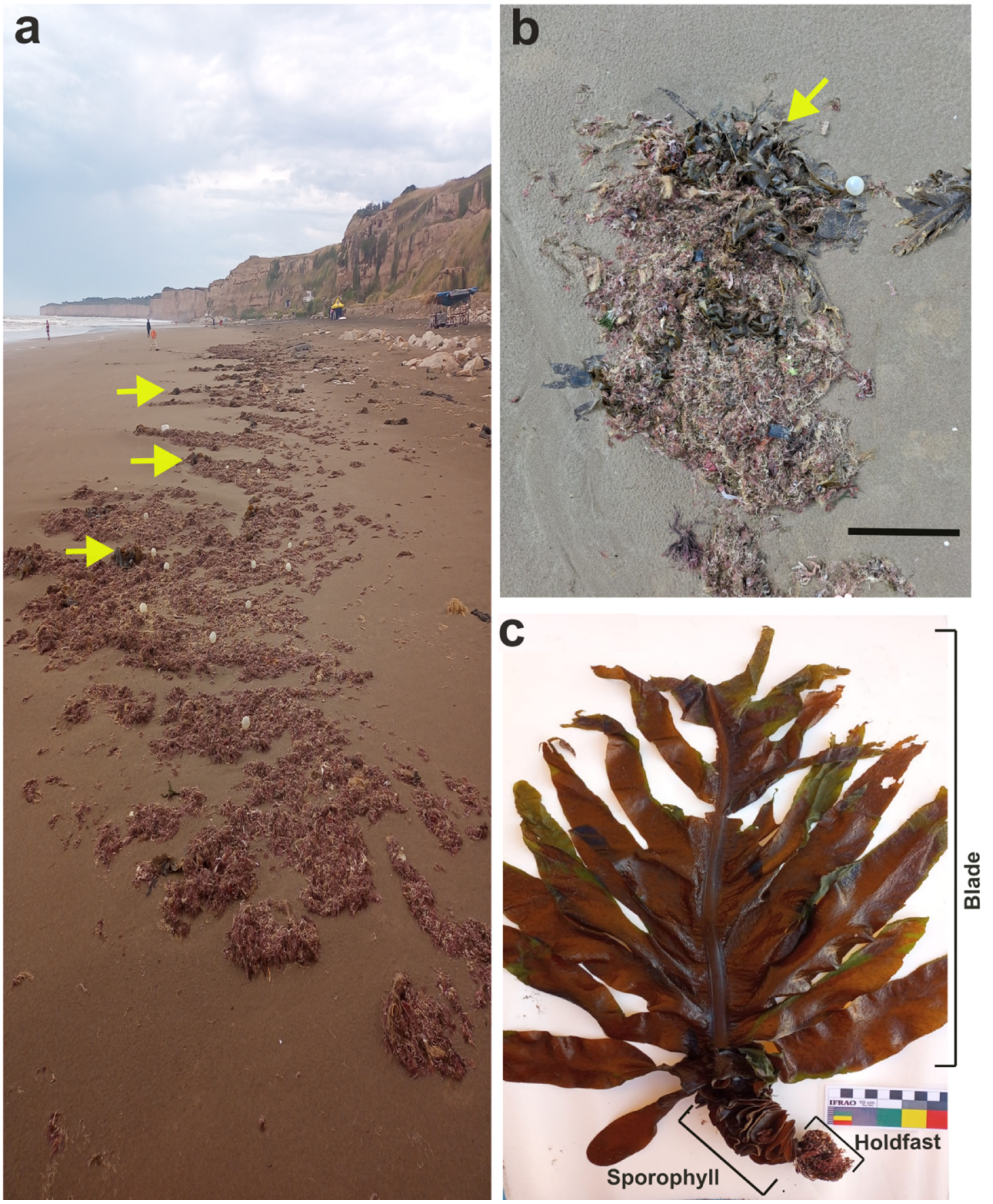

Figure 1. A) General view of beach-cast macroalgae; arrows indicate some *Undaria pinnatifida* thalli. B) Detail of a patch of beach-cast macroalgae; arrows indicate *U. pinnatifida* thalli (scale: 30 cm). C) *U. pinnatifida* thalli found in the beach-cast, showing blade, sporophyll and holdfast (scale 10 cm).

beach tourism season. In this context, regular beach clean-up is needed, which requires significant economic expenditure exerted by municipal authorities. In Mar del Plata, the occurrence of *U. pinnatifida* in coastal beach-casts is expected to increase due to both population growth and the projected intensification of southwest winds in the area (Vallarino-Castillo et al. 2024), which could detach the thalli. Consequently, greater amounts of stranded biomass are expected to occur in sub-

Table 1. Relative biomass percentage (%) of macroalgae species recorded in two beach-cast of Mar del Plata city. *Data from Becherucci and Benavides (2016). **Fragmented material, identification uncertain between *Schizymenia dubyi* and *Grateloupia* sp. ***In Becherucci and Benavides (2016), reported as *Gigartinaceae* indet.

			Relative wet biomass (%)	
Phylum	Order	Species	This study	2016*
Heterokontophyta	Dictyotales	*Dictyota* spp.	5.76	0.09
	Laminariales	*Undaria pinnatifida* (Harvey) 1873 Suringar	26.28	0
Rhodophyta		Rhodophyta indet. (*Schizymenia-Grateloupia* complex)**	1.75	32.85***
	Corallinales	*Jania rubens* (Linnaeus) J. V. Lamouroux 1816	1.77	2.82
		Bossiella sp.	0.09	0.85
		Corallina officinalis Linnaeus 1758	1.14	13.18
	Ceramiales	*Anotrichium furcellatum* (0.06 J. Agardh) Baldock 1976	3.52	
		Pterosiphonia sp.	0.13	0.03
		Callithamnion sp.	0.54	0.15
		Ceramium spp.	0.69	0.58
		Polysiphonia sp.	0.012	0
		Chondria sp.	4.49	2.85
	Rhodymeniales	*Rhodymenia* sp.	5.28	23.15
	Gigartinales	*Ahnfeltiopsis* sp.	1.15	14.33
		Gymnogongrus torulosus (J. D. Hooker and Harvey) F. Shmitz 1897	0.33	0.43
Chlorophyta	Ulvales	*Ulva* spp.	0.18	0.06
	Bryopsidales	*Codium fragile* (Suringar) Hariot 1889	25.44	5.01
		Bryopsis plumosa (Hudson) C. Agardh 1823	0.27	0
Algal remains			24.67	0.06

sequent summers. The biomass of macroalgae deposited on sandy beaches is utilized by societies in several coastal regions around the world (Harb and Chow 2022). The main interest in the use of beach-cast macroalgae lies in obtaining primary and secondary metabolites that promote a variety of applications in the food, pharmaceutical, and cosmetic industries (Gómez et al. 2013). In this context, wild sporophytes of *U. pinnatifida* are harvested in Argentine Patagonia to produce *wakame* and as a source of sulphated polysaccharides (i.e. *fucoidan*) (Rebours et al. 2014; Arijón et al. 2021). In addition, numerous studies have explored its potential applications, particularly as a source of food (Raffo et al. 2022; Arijón et al. 2023). In Mar del Plata, this species has been investigated in several prospective studies exploring a wide range of potential applications (Salcedo et al. 2020; Martínez

and Becherucci 2022; Lobato et al. 2023). The accumulation of *U. pinnatifida* in beach-cast deposit may provide opportunities for the sustainable use and valorization of stranded biomass, while simultaneously creating opportunities for monitoring and management efforts aimed at tracking its spread along the coast. Finally, we encourage coastal users and naturalists to report observations of beach-cast macroalgae, as these records can provide valuable information for improving our understanding of macroalgal distribution patterns along the Argentine coastline.

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Author contributions

M. Eugenia Becherucci: investigation; conceptualization; writing-original draft; species-level identification. Juan Pablo Seco Pon: investigation; conceptualization; editing-original draft and figures.

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